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## I. INTRODUCTION

The fundamental public interest objective in setting policy toward public safety radio is to protect life and property to the fullest extent possible at the lowest possible cost to society. To achieve this objective, the technology used by public safety agencies should satisfy four criteria:

- *Economic resources, including spectrum, should be used efficiently.* Electromagnetic spectrum is a scarce and valuable resource worth billions of dollars. In light of the present scarcity, there should be a mechanism for allocating spectrum among competing uses and ensuring that it is not wasted. In the absence of market forces, there should be regulatory efficiency standards. Only in this way will the overall social benefits derived from the use of spectrum be maximized.
- *Sufficient interoperability among the radio systems of different public safety agencies should be achieved to allow effective and reliable interagency communications.* There are many situations in which it is important for members of different public safety agencies to be able to communicate with each other quickly, reliably, and securely. For example, local, state, and federal agencies all may be involved in responding to a flood or earthquake. The lack of interoperability can limit their ability to communicate with one another and thus limit their ability to tackle these natural disasters in a coordinated manner. Consequently, a critical issue for policy makers and public safety radio users is the degree to which the relevant components of two networks are technically capable of working with one another, or are *interoperable*.<sup>1</sup>

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<sup>1</sup> There are a variety of definitions that attempt to state this concept precisely. For instance, the Information Infrastructure Task Force has defined interoperability as the ability to transfer information "over the disparate networks easily, accurately, and without compromising the content of the messages". *The National Information Infrastructure*:

- *Public safety users should have the ability to utilize new and advanced services and applications as they become available.* It is important to consider the ability of a public safety radio technical specification to meet future service demands. At present, it appears that high-bandwidth applications (e.g., the transmission of fingerprints, mugshots, building diagrams, and full motion video) will be of much greater importance in the future than they have been to date.<sup>2</sup> Of course, it is impossible to predict fully what will be the key applications of the future. Hence, it is important to avoid locking-in a technology that lacks flexibility.
- *There should be vigorous competition in the supply of both public safety wireless infrastructure and mobile and portable equipment.* Competition is not an end in itself, but rather a means of attaining important public interest objectives. Competition leads to lower prices, which in turn lower the expenses borne by public safety agencies and stimulate the efficient use of public safety radio. Competition lowers prices both by driving prices downward toward efficient, cost-based levels and by promoting cost-reducing innovation and investment. This innovation and investment also raises quality and creates more choices for end-users.

Today, it is widely recognized that the best way to promote the public interest is to promote competition in the provision of telecommunications equipment and services. This principle has been embraced by Congress—one of the primary aims of the

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*Agenda for Action*, Information Infrastructure Task Force, September 15, 1993, at 9.  
<sup>2</sup> *Notice of Proposed Rulemaking*, WT Docket No. 96-86 (hereafter *NPRM*), ¶ 48.

Telecommunications Act of 1996<sup>3</sup> is to foster telecommunications competition—and has also been central to Federal Communications Commission (Commission) policy making in recent years. Competition has brought tremendous benefits in the long-distance telephony and customer premises equipment markets. Competition in the provision of public safety radio is equally important.

## II. PUBLIC POLICY TOWARD STANDARD SETTING

### A. Policy Alternatives

In examining public policy toward standards, it is important to distinguish between two senses in which a *standard* can be mandated for public safety wireless. A *performance standard*, or functional requirement, defines certain criteria that a radio system must be able to satisfy without specifying the specific technology. For example, the Commission might mandate that any public safety radio system meet certain requirements for spectral efficiency.

A *technical compatibility standard* specifies a particular interface that allows components of different systems to work together. A technical compatibility standard is one means of implementing a performance standard that calls for interoperability. But it is a restrictive means. By their nature, technical compatibility interfaces tend to place greater restrictions on the choice of technology than do general performance standards.

Private-sector wireless voice services provide a useful example of this distinction. Time division multiple access (TDMA) and code division multiple access (CDMA) both are technical standards for digital cellular telephony, and each is incompatible with traditional analog cellular

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<sup>3</sup> Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56. The 1996 Act amends the Communications Act of 1934, 47 U.S.C. §§ 151 *et. seq.*

systems. Yet an interoperability performance standard (to provide roaming capabilities) can be met through the use of dual mode handsets. Thus, under a performance standard, marketplace participants are free to pursue the technology that they feel best serve their needs, while still achieving interoperability.

There are two ways that governmental decisions can influence the attainment of either performance or technical compatibility standards:

- *The Exercise of Buyer Power.* High-volume buyers such as the federal government have the potential to promote a particular standard through their procurement decisions. Due to economies of scale and scope in production, suppliers will tend to make all of their equipment meet the same specification. Thus, if the federal government specifies that certain standards must be met to qualify for its patronage, even equipment produced for other users may end up meeting those standards.<sup>4</sup> Moreover, other buyers may look to the federal government to provide leadership and build on its expertise. The federal government should take this influence into account.
- *Mandatory Standard-Setting Guidelines.* The coercive power of the state can be used either to guide private standard setting or to impose standards directly chosen by the government.

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<sup>4</sup> Similar effects have arisen in other contexts. For example, California has set air quality standards for paints and automobile emissions that have become de facto federal standards.

Public policy toward either de facto or de jure performance standards and technical compatibility standards for public safety radio should be based on an analytical framework that explicitly accounts for costs and benefits.<sup>5</sup>

### **B. A Cost-Benefit Analysis from a User Perspective**

*In their role as buyers* of public safety radio equipment, federal and other governmental agencies should take care not to promote an outcome that has the unintended consequences of making interoperability more difficult to achieve, blocking the use of new services, or lessening competition. Otherwise, the result will be higher costs and lower quality from the user's perspective.

There are also effects about which the agency might not care directly as a user, but that still are part of the public interest. In particular, from a public interest perspective, federal users should be concerned about (a) spectrum efficiency and (b) the costs that they impose on other users through their choice of technology. The costs borne by others could arise because federal users adopt a technology that is either non-optimal for other users or diminishes competition in the market for public safety radio equipment. These effects are discussed at greater length below as part of the examination of the costs and benefits of mandatory standard setting.

### **C. A Cost-Benefit Analysis of Mandatory Standard Setting**

Now consider the costs and benefits of mandating a standard.

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<sup>5</sup> See Katz, M., G. Rosston, and J. Anspacher, "Interconnecting Interoperable Systems: The Regulator's Perspective," *Information, Infrastructure and Policy* 4 (1995) for an application of this approach to the question of telephone local exchange carrier interconnection standards.

(i) **Costs of mandatory standard setting.** The costs of a standards *policy* (as opposed to the standard itself, which typically also will be costly) arise from a number of sources:

- *Administrative costs of regulation.* Both policy makers and private parties will incur costs designing and implementing the standards policy.
- *The policy may force standards in situations where costs exceed the benefits.* When rival standards have distinct features sought by certain consumers, some of these features may be lost in the move to a standard.<sup>6</sup> A market equilibrium in which multiple incompatible products have significant sales may reflect the social value of variety, rather than indicating some sort of market failure that is generating insufficient interoperability.<sup>7</sup>

Many parents who enjoy taking videos of their children with compact cameras using the 8mm format would be worse off if they had been denied their preferred choice because all video cameras and players had been forced to be VHS compatible.

The uncertainties of technological progress give rise to another cost of standardization, particularly early on in the life of a new technology: standardizing on a single system can be very costly if the system selected turns out to be inferior to another system. In light of the long lives of investments and the desire to achieve interoperability, it can be very difficult to switch horses in midstream to a system that later proves superior. For example, the Japanese analog HDTV system is now widely regarded as inferior to the system being developed for use in the United States; NHK and other

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<sup>6</sup> It should be noted that these costs are likely to be particularly significant for technical compatibility standards.

<sup>7</sup> For a discussion of the tradeoff between standardization and variety, see J. Farrell and G. Saloner, "Standardization and Variety," *Economic Letters*, 20 (1986): 71-74.

Japanese suppliers did not expect a workable all-digital system to be feasible before the turn of the century, so they focused their efforts on an analog system. Because the Japanese were promoting a single standardized system, they were not well placed to offer a digital system when such systems were recognized as feasible. Recently, Japan announced that it too will move to a digital system, but it is now well behind the United States and it will be expensive to catch up.

The problem of imposing standards whose costs exceed their benefits is made particularly difficult by the fact that many of the costs are indirect and hard to measure. For example, it is probably impossible to obtain a precise measure of the extent to which future innovation is reduced through the imposition of a standard that restricts the directions technology can take. These measurement difficulties, however, make the costs no less real.

- *The policy may force the choice of the wrong standard.* There are right and wrong standards. Unfortunately, it is easy to make mistakes and difficult for policy makers to get the information needed to make good decisions. This is particularly true in the case of standard setting at the start of technology's life (in the present instance, digital radio). In such situations, it may be very difficult to determine which standard is the "correct" one because this will depend in large part on the prospects for *future* quality improvements, cost reductions, and the development of new services. As noted earlier, the policy maker's task is made more difficult by the problems inherent in measuring costs and benefits.

Moreover, the government may have a significant informational disadvantage relative to private parties when emerging technologies are involved. Due to their greater expertise and experience, market participants— both equipment suppliers and public safety agencies—are likely to have better information about needs and opportunities than is an outside party, such as the Commission or the National Telecommunications and Information Administration (NTIA). Unfortunately, policy makers cannot simply ask private parties to provide the needed information about cost and demand conditions. In addition to honest differences of opinion, self-interested parties will have incentives to slant their reports. This last point reflects the fact that a standard can have the (possibly unintended) effect of favoring some providers over others and thus violating the principle of competitive neutrality by which policy makers generally should abide.

Setting a bad *mandatory* standard can be particularly costly because there may be no market mechanism to override it. In general, market processes provide a safety valve that government fiat lacks. There is evidence today that this safety valve sometimes works. Once it was confronted with the adverse consequences of mandating the ability to migrate to the APCO Project 25 specifications in its procurement of an 800 MHz trunked radio system, the City of Las Cruces reversed its decision.<sup>8</sup> Had the APCO Project 25 specification been mandated by Commission order or made the de facto standard by the actions of the General Services Administration or the National Communications System, then Las Cruces would not have been able to correct its mistake.

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<sup>8</sup> See D.N. Hatfield, "The Price of a Standard: Las Cruces, New Mexico," Hatfield Associates, Inc., February 27, 1996.

These considerations of the costs of intervention suggest two broad conclusions with respect to government standard setting:

1. *Policy makers should be wary of formally setting a standard at all, in light of the high potential costs of mistakes.*
2. *Where a standard is set, public policy should specify the least restrictive standard consistent with achieving public interest objectives.* In many cases, this will mean setting a performance standard, rather than a technical compatibility standard or specification of technology. By setting a performance standard, policy makers may be able to avoid the costs from the loss of variety and innovation, as well as the harm to competition.

**(ii) Benefits of mandatory standard setting.** The benefits of the government's mandating a standard derive from inducing a standard that generates greater overall consumer and producer benefits than would the unregulated market outcome. As noted in the discussion of the costs of government standard setting, suppliers and users are likely to be better informed about technology and demand conditions than are policy making agencies that are not directly involved in the market. This fact appears to favor allowing public safety radio equipment producers and public safety agencies to set their own standards. Although in many ways appealing, this approach can lead to seriously flawed outcomes unless policy makers are careful to account for the fact that private parties will act in self-interested ways.

While each party can be expected to pursue its private interest in standard setting—whether it is through a market-driven process or through a government proceeding—it is vital to see that the public interest is protected as well. It is important to ask whether private parties are

somehow biased for or against a standard by virtue of their focus on their own economic welfare rather than that of society as a whole.

While policy makers should favor maximizing total net benefits enjoyed by society, a firm can be expected to maximize its profits. Consequently, a firm may have biased incentives. Acting to influence standard setting is now recognized as an important dimension of competitive strategy in many markets, including computer hardware, computer software, and consumer electronics. Indeed, Professor David Yoffie of the Harvard Business School recently wrote that "[i]t has become a cliché to pronounce that winners in this new digital world will set and control the standards."<sup>9</sup> If a particular standards choice will weaken its rivals' ability to compete, a firm will tend to favor that course of action even though competition and consumer welfare are harmed.

Although end users typically do not compete with one another, similar sorts of effects can arise. In particular, end users may disagree on the relative desirability of alternative standards. For example, an end-user may have made a sunk investment in a given technology and want to protect its investment by advocating a standard that allows relatively easy migration. Thus, those members of the Project 25 steering committee who represent agencies already using Motorola equipment may have incentives to see that Project 25 favors technologies that will work well with their installed systems. Another end user may have invested in a different technology. Or, one standard may better serve the interests of urban users than rural ones. Individual users

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<sup>9</sup> D. Yoffie, "Competing in the Age of Digital Convergence." *California Management Review* 38 (Summer 1996) at 44.

typically ignore the effects that the standards choice has on other users. Hence, to the extent that users have different preferences over different standards, there will be conflicts.

What all of this means is that there may be market failures.<sup>10</sup> In such cases, governmental intervention may be able to improve the outcome. In light of the difficulties inherent in governmental standard setting, however, it is important that any intervention be limited to the correction of specific, well-defined market failures.

### **III. SPECIFIC POTENTIAL MARKET FAILURES**

Turning from the general to the specific, the present section examines how the market may fail to serve the public interest along each of the four policy concerns identified at the start of this paper.

#### **A. Efficient Use of Spectrum**

At present, electromagnetic spectrum is a scarce and valuable resource. In light of this scarcity, there must be a mechanism for allocating spectrum. The solution preferred by most economists is to rely on market forces. Under this approach public safety users would purchase the rights to use spectrum on an open market the way they buy the other inputs needed to produce health and safety services. Economists favor this approach because it gives public safety agencies proper incentives to economize on their use of spectrum. For a variety of reasons, however, public policy makers have chosen not to utilize the market to allocate spectrum used by public safety services, and there is no price mechanism to create incentives for public safety organizations to conserve spectrum use. Consequently, to the extent that less spectrally efficient

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<sup>10</sup> It is important to recognize that the failure to adopt a standard is not, in itself, a sign of market failure. Rather, the market's decision not to standardize may reflect the fact that,

equipment is cheaper, a rational agency will substitute spectrum for capital. That is, it will use all of the spectrum allocated to it and then seek additional allocations.<sup>11</sup> Because the agency does not face the true social cost of the spectrum, it will tend to waste spectrum from the perspective of overall national welfare.

Short of creating markets for public safety spectrum, there are two responses to this problem. One is to refuse to increase public safety allocations. This approach would prevent additional inefficiency and, as demand grows, public safety users would be under pressure to use spectrum more efficiently. There are, however, serious problems with this approach. Most important, even efficient public safety users may have legitimate needs for additional spectrum. This fact makes it both unlikely and undesirable that public decision makers would support this policy. The second approach is to mandate performance standards for the spectral efficiency of public safety radio. This approach promotes efficiency and can be coupled with additional spectrum allocation to ensure that public safety radio capacity needs are met.

#### **B. Interoperability and Network Effects**

There are many situations in which it is important for members of different public safety agencies to be able to communicate with each other. The benefits of interagency communication are an example of what economists refer to as *network effects*, whereby the value of a service to any one user is an increasing function of the number of other users with whom he or she can

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at present, the costs of standardization exceed the benefits.

<sup>11</sup> It thus is not surprising that the Project 25 Steering Committee and many public safety radio users support the Public Safety Wireless Advisory Committee's call to allocate approximately 100 MHz of additional spectrum to public safety radio. See Comments of the Project 25 Steering Committee at 3-5 in WT Docket No. 96-86, October 21, 1996.

communicate using that service.<sup>12</sup> In the presence of network effects, the ability of a user who normally communicates over radio network *A* to communicate with users who normally communicate through radio network *B* can be an important benefit to the user of network *A*. However, individual users typically ignore the effects their adoption decisions have on other users. Thus, users of network *B* may fail to take these benefits to user *A* into account when making their equipment purchase decisions. Similarly, if adoption of a standard is costly to user *B*, *B*'s incentives to support the standard may be too low because *B* fails to account for the benefits to *A*. In the absence of some means to induce users to take the implications for other users into account, network *effects* become network *externalities*. In these situations, there may be too little interoperability. Hence, one potential role for federal government intervention is to promote interoperability.

It is important to recognize that there are several means by which interoperability across public safety radio systems can be attained. Alternatives include: having all public safety users purchase the same radio systems (that is, packages including everything from base stations to mobile receivers); utilizing standardized interfaces that allow components of different systems to work together (*i.e.*, implement a technical compatibility standard); and operating adapters or gateways that translate between otherwise incompatible systems. The choice among these alternative means of achieving the desired interagency communications capabilities should be based on the performance and total social cost of each alternative. In this regard, it is worth noting that the greater the degree of technological change or uncertainty, the larger are the costs

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<sup>12</sup> For an overview of the economics of network effects, see M. Katz and C. Shapiro, "Systems Competition and Network Effects," *Journal of Economic Perspectives*, 8

associated with a technical compatibility standard, which tends to limit the ability of providers to adapt to, or take advantage of, technological developments.

### **C. Ability to Support New and Advanced Services**

Individual public safety agencies have incentives to purchase radio systems that have the ability to support innovative new services as they become available. In perfectly competitive markets, buyers could be expected to make efficient tradeoffs between equipment costs and the ability to support new services. In practice, the market may not work so well for two reasons. First, one or more suppliers may have market power. In the absence of full competitive pressures, a supplier may not be compelled to offer buyers efficient options. Second, standards mandated to address other concerns (*e.g.*, interoperability) may inadvertently limit end users' ability to purchase flexible, forward-looking systems. This potential problem is one consequence of the more general fact that the choice of a standard can have significant consequences for industry costs and the rate of innovation. Again, these considerations suggest that gateways to achieve interoperability may be preferable to a technical compatibility standard.

### **D. Competition**

While it is difficult to conceive of a performance standard directly mandating competition, the choice of either a particular performance standard or a particular technical compatibility standard can have significant consequences for the intensity and nature of competition. These competitive effects ultimately will affect the life-cycle costs that public safety radio users pay, as well as the underlying costs borne by manufacturers and the rate of innovation.

There is now a large literature examining a firm's incentives to manipulate the standards process to gain competitive advantage.<sup>13</sup> A firm may refuse to create standards,<sup>14</sup> or may slant the standard in a particular way, in order to raise the costs of competing incumbents (and thus weaken their ability to compete) or to deter entry by new providers. This is one example of what is known more generally as *raising (actual and potential) rivals' costs*.<sup>15</sup>

There are at least three ways to slant standards to create competitive advantage:

**(i) Strategic Standard Setting to Create Production Cost Advantages.** Different standards may give rise to competitive advantage for one provider by being better suited to its productive assets (*e.g.*, plant, equipment, proprietary technology, and technical know how) than to others'. If a supplier is successful in promoting a standard that disadvantages its rivals by raising their production costs, the firm will be able profitably to increase its prices or market share, *ceteris paribus*. Of course, in promoting a particular standard, a firm may only be seeking to lower its own costs. This, in itself, is not an indication of anticompetitive intent or inefficiency. Consequently, it may be difficult to discern this effect in practice. But policy makers should watch for standards that are over-reaching and limit the choice of technology in ways that do not serve public interest objectives.

**(ii) Strategic Use of Intellectual Property Rights and Standards to Limit Competition.** When standards embody proprietary technology, a firm may be able to limit

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<sup>13</sup> This literature is surveyed in M. Katz and C. Shapiro, *op. cit.* and in P. David and S. Greenstein, "The Economics of Compatibility Standards: An Introduction to Recent Research," *Economics of Innovation and New Technology* 1 (1990): 3-41.

<sup>14</sup> See, for example, M. Katz and C. Shapiro, "Network Externalities, Competition, and Compatibility," *American Economic Review*, 75 (June 1985): 424-440.

<sup>15</sup> See S. Salop and D. Scheffman. "Raising Rivals' Costs," *American Economic Review*

competition by controlling the terms under which its rivals utilize that technology. Generically, there are two ways in which this can be done.

- *High Licensing Fees.* By setting relatively high per-unit licensing fees, a firm can drive up the marginal costs of its rivals. This cost increase will tend to induce other firms to raise their prices and/or reduce their output levels. In either case, competition is weakened and consumers harmed. While fixed fees are unlikely to affect a firm's pricing strategy (at least according to economic theory), high fixed fees can discourage firms from being in the market at all. Again, competition is weakened and consumers harmed.
- *Restrictions on the Use of the Licensed Technology.* There are several types of restriction that a firm might impose on its licensees, including (a) geographic market restrictions; (b) customer restrictions (by type rather than location); and (c) product restrictions (*e.g.*, the allowed use of the intellectual property would not include production of complete systems). In each case, the restriction directly limits competition. The restriction may also limit competition indirectly by making overall entry unprofitable. This type of effect arises when restrictions on the use of the licensed intellectual property prevent the entrant from taking advantage of economies of scale and scope in production.

The use of proprietary technology embedded in standards to disadvantage rivals is of concern to both antitrust authorities and standards bodies. Dr. Carl Shapiro, then Deputy Assistant Attorney General for Economics at the U.S. Department of Justice, recently noted the importance of ensuring that any proprietary technology embedded in a standard is licensed on

reasonable terms and that firms are not able to use such intellectual property to increase their market power by manipulating or abusing the standards process.<sup>16</sup>

Because of these concerns, standards organizations typically require that the holder of an intellectual property right commit to licensing that intellectual property on reasonable and nondiscriminatory terms before that technology can be incorporated into the standard. Both the International Standards Organization and the American National Standards Institute have such requirements,<sup>17</sup> as does the IEEE.<sup>18</sup>

**(iii) Systems Bundling to Deter Entry and Limit Competition.** Compatibility and interoperability issues concern making the components of different systems work together through standardized interfaces. There may be many points at which these interfaces can be defined. That is, the extent of unbundling is the result of choices made by market participants and government policy makers. As is recognized in the Telecommunications Act of 1996 with respect to local exchange networks, the extent of unbundling can have extremely powerful effects on the nature and degree of competition.

Unbundling systems by achieving interoperability at a level of greater disaggregation may give rise to several benefits. First, by allowing greater producer flexibility, it may increase the realization of economies of scale and scope, learning, and technological spillovers in the development and production of specific components. Compatibility also enhances variety by

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<sup>16</sup> C. Shapiro, "Antitrust in Network Industries," address before the American Law Institute and American Bar Association "Antitrust/Intellectual Property Claims in High Technology Markets," text released March 7, 1996, at 23-25.

<sup>17</sup> *Ibid* at 21.

<sup>18</sup> "IEEE Standards Operations Manual," Section 6.3.1, April 1995.

allowing end users to mix and match (differentiated) components from various systems.<sup>19</sup>

Moreover, even with homogenous components, compatibility allows users to seek the cheapest one, component by component. Having compatible components also allows end users to exploit economies of scope in producing different services for their own use. For example, the compatibility of consumer entertainment products can allow a single audio amplifier and set of speakers to be used with a television monitor, compact disk player, tuner, and home computer. Similar benefits may arise in public safety radio as equipment and services evolve.

In the light of these benefits, why would firms oppose unbundling? First, for systems that are compatible, the locus of competition shifts from the overall package to the specific cost and performance characteristics of each component individually.<sup>20</sup> This general principle implies that if one firm has a distinctly superior overall package—including its product offering, its installed base, and its reputation—then that firm is likely to prefer incompatibility and may in fact spend resources to block compatibility.

Incompatibility that limits unbundling also discourages entry. When all other firms sell closed, integrated systems, a new entrant would have to offer integrated systems of its own. To be successful, the entrant would have to have the ability to come in as a full-line producer. A potential entrant is less likely to have the full skills needed to enter as a complete systems

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<sup>19</sup> See, for example, C. Matutes and P. Regibeau, "Mix and Match: Product Compatibility Without Network Externalities," *Rand Journal of Economics*, 19 (Summer 1988): 221-234.

<sup>20</sup> See generally C. Matutes and P. Regibeau, *op. cit.* and N. Economides, "Desirability of Compatibility in the Absence of Network Externalities," *American Economic Review*, 79 (December 1988): 1165-1181.

producer. In addition, by requiring sunk investments in know how and production facilities for a greater number of components, the risk of entry is greater.

### **E. Summary**

In summary, while there are high potential costs of government intervention, there are at least three reasons that might warrant it:

- *Making up for the lack of a spectrum market.* Public safety radio users and producers have attenuated incentives to achieve spectral efficiency because they do not face the social costs of their spectrum use.
- *The public interest in competition.* When the standards process is driven by suppliers—or suppliers have the ability to veto certain outcomes—privately generated standards (or their lack) may lead to insufficiently competitive outcomes.
- *Resolving coordination failures.* While providers and end users might collectively benefit from standards, differences in their objectives may lead to a breakdown in cooperation.

These considerations lead to three general conclusions about the proper role of public policy in setting standards for public safety radio:

- *Set a spectrum efficiency performance standard.* Such a standard is needed to ensure that public safety wireless users do not waste spectrum as a result of the lack of a price mechanism for allocating this scarce resource.
- *Block the adoption of standards that harm competition.* The federal government, both the Commission and other agencies, should not allow other parties to put in place a

standard that significantly diminishes competition in the provision of public safety radio equipment. An agreement that creates a proprietary standard, for example, is unlikely to serve the public interest. Similarly, it would be unwise to adopt a standard that does not have well-defined licensing agreements with reasonable terms to cover any proprietary technology on which the standard is based.

- ***Set in motion an open and democratic process to develop a means of achieving interoperability.*** As discussed earlier, individual users typically ignore the effects that standards decisions have on other users and producers may attempt to use standard setting to disadvantage their rivals. Thus, it is important that the standard setting process reflects a balance of broad interests and makes use of information provided by a wide range of parties. In the case of digital television, the Commission played a role in seeing that the process was open and inclusive. It also provided a forum for all parties to comment on the appropriateness of the standard. In promoting a similarly open process for public safety radio, the Commission should also ensure that the resulting solution is one that promotes spectrum efficiency and competition.

Section 273(d)(4) of the Communications Act of 1934 as amended<sup>21</sup> provides principles on which to build such a process. Section 273(d)(4) calls for a process that invites full participation of interested parties, entails a full and open debate of the issues, contains on a well-defined dispute resolution process, and does not monopolize or attempt to monopolize relevant markets. The fact that Congress chose to make this amendment to the Communications Act of 1934 as part of the sweeping reforms of the

Telecommunications Act of 1996 underscores the importance of having open and fair processes for the development of future standards. The arguments in favor of open and fair processes for the development of future equipment and systems standards are as compelling for public safety wireless as they are for wireline telephone local exchange service.

#### **IV. ADOPTION OF APCO PROJECT 25 SPECIFICATION AS A STANDARD COULD THWART PUBLIC INTEREST GOALS**

APCO Project 25 is a joint effort of the Association of Public-Safety Communications Officials-International, Inc. (APCO), the National Association of State Telecommunications Directors, and representatives of certain federal agencies. Established in 1989, the main goals of the project are the development of standards for digital public safety radio. The APCO Project 25 standards-definition process is several years behind schedule and the specification is not fully developed at this date.<sup>22</sup> This incompleteness makes it difficult for market participants and others to evaluate it fully. However, it can be said that both the process and the outcome of APCO Project 25 have troubling features.

First consider process. As discussed above, both end users and manufacturers may have vested interests. In particular, manufacturers may have incentives to use standards to create competitive advantage for themselves and to raise rivals' costs. Similarly, those members of the APCO Steering Board whose public safety entities already have purchased Motorola systems may have incentives to "validate" or "ratify" their earlier decisions by supporting the Project 25

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<sup>21</sup> 47 U.S.C. 273(d)(4).

<sup>22</sup> "APCO 25 'Still Evolving.' Vendor Says; Console Protocol Undefined," *Land Mobile*

specification, while a party with no current investment in Motorola equipment would not. Similar differences in users' preferences arise to the extent that the choice of specification differentially affects users' costs of migrating from analog to digital radio systems depending on their legacy systems. In light of conflicting user and vendor interests, it is important that standards development take place in an open, democratic process with broad representation of all industry participants. If the process does not satisfy these criteria, the resulting standard may inefficiently favor one group of manufacturers or end users at the expense of others.

There are indications that the APCO Project 25 process may not have been well-suited to dealing with the conflicts that often arise in standard setting due to the divergence of interests.

According to the co-chairman of the Project 25 Steering Committee, members of the committee

failed to recognize early on the complex problems associated with IPRs [intellectual property rights] are directly and indirectly related to intent, purpose, money, and the individual companies' corporate business plans.<sup>23</sup>

As discussed below, the treatment of intellectual property rights continues to be a source of concern for harm to the public interest.

Turning from process to output, the APCO Project 25 specification appears to have several features that will work against the public interest rather than promote it.

#### **A. Inefficient Use of Spectrum**

It appears that implementation of the APCO Project 25 specification as a standard would block the adoption of other technologies that potentially use spectrum more efficiently.<sup>24</sup> In light

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*News*, 50 (June 7, 1996) at 1,3.

<sup>23</sup> Letter from Craig M. Jorgensen, Co-chairman, Project 25 Steering Committee, to Loren Kargh, consultant, Cycomm Corporation, November 1, 1994, at 2.

<sup>24</sup> Moreover, by stifling competition, adoption of the APCO Project 25 specification would

of the high value of land mobile spectrum and the current calls for additional allocation of spectrum to public safety wireless communications, this is an important consideration.

The issue of spectrum efficiency centers on the use of frequency division multiple access (FDMA), rather than TDMA or CDMA. There appears to be agreement that, if all public safety spectrum were under the control of a single entity, then TDMA or CDMA technologies could clearly provide much greater communications services—measured either in terms of peak calling capacity, spectrum efficiency (*e.g.*, kbps/hz), or the ability to provide advanced, high-capacity applications (*e.g.*, transmission of video)—than could FDMA.<sup>25</sup> Thus there appears to be agreement that the use of TDMA or CDMA is more efficient than FDMA for large agencies or collections of agencies sharing a system. Proponents of FDMA, however, argue that it is better suited to agencies who have low volumes of traffic and refuse to share systems/spectrum with other public safety entities.<sup>26</sup> Superficially, this debate appears to suggest that no technology is any better than the others in terms of spectral efficiency and thus spectral efficiency should not be a consideration in setting a standard. Such a conclusion misses four important points.

First, through the use of innovative sharing arrangements among public safety entities, even small users may enjoy the efficiencies of TDMA and CDMA.<sup>27</sup> Second, even if there are

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likely decrease future innovation in the area of spectrum efficiency. In discussing why public safety communications is "more cumbersome than necessary," the *NPRM* ¶16 states that "there is limited competition among equipment and service providers of public safety communications."

<sup>25</sup> See, for example, Letter from Craig Jorgensen on behalf of APCO 25 Steering Committee to Charles O. Gibson, Director Communications and Information Systems Department, Midland, Texas, 21 December 1993, which is generally critical of TDMA.

<sup>26</sup> See, for example, C. Jorgensen and J. Powell, "Setting the Issues Straight," *APCO Bulletin* (July 1993).

<sup>27</sup> *NPRM* ¶¶ 53 and 54. It is worth noting that the Commission recently took steps to